

ABSTRACT OF THE DISCLOSURE

Ultra-thin oxide layers are formed utilizing low pressure processing to achieve self-limiting oxidation of substrates and provide ultra-thin oxide. The substrates to be processed can contain an initial dielectric layer such as an oxide layer, an oxynitride layer, a nitride layer, a high-k layer, or alternatively can lack an initial dielectric layer. The processing can be carried out using a batch type process chamber or, alternatively, using a single-wafer process chamber. One embodiment of the invention provides self-limiting oxidation of Si-substrates that results in SiO<sub>2</sub> layers with a thickness of about 15 Å, where the thickness of the SiO<sub>2</sub> layers varies less than about 1 Å over the substrates.